United States Department of Agriculture
Forest Service

Logging and Transportation Report
Economic Analysis

2017 Upper Briggs Restoration

Rogue River – Siskiyou National Forest
Wild Rivers Ranger District

Photo by Wesley H. Crum – Example of medium sized swing yarder, Siskiyou National Forest

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Introduction

This report gives a brief overview and comparison about the value and economics of the proposed action and other alternatives. The primary comparison will utilize an economic efficiency analysis, which compares expected revenues from a project to the costs for the agency to implement the project. This allows for the calculation of a cost to benefit ratio, providing a simple method for analyzing alternatives. Zone average costs from recent timber sale appraisals will be used for the costs associated with the activities proposed. These costs will be subtracted from the expected value for Douglas-fir saw logs to give a total value that a timber sale contract or stewardship might expect to generate. This analysis uses zone average costs calculated for logging and hauling of timber to the local market. A more accurate appraisal of the project would be completed during project implementation. This analysis estimates that the potential receipts back to the government for Upper Briggs Restoration would be approximately $1,989,219 for the proposed action.

Regulatory Framework

Planning Area Land Allocations

The Upper Briggs Restoration project is all within land allocations designated as Matrix, Riparian Reserve and Administratively Withdrawn by the Northwest Forest Plan (NWFP) (USDA and USDI 1994 b, c). A brief description of applicable Management Allocations/Prescriptions is provided below. More detailed descriptions can be found in the Northwest Forest Plan, and the Siskiyou National Forest Land and Resource Management Plan.

Matrix

This allocation emphasizes obtaining a full yield of timber within the capability of the land. Most scheduled timber harvest and other silvicultural activities would be conducted in that portion of the Matrix with suitable forest lands (NWFP, page C-39). Matrix lands allocated under the NWFP that include all areas not otherwise designated to a more protective status under the LRMP. The project area primarily includes lands allocated to Matrix, as carried forward from the 1989 LRMP as General Forest Prescription (Management Area 14). Within this area, several areas are further managed for the visual resources. The Partial Retention Visual is intended to be restrictive to the application of regeneration harvests which uses partial retention to mitigate the visual concerns. Since the silviculture prescriptions are to meet the objectives by thinning, the visual concerns are accounted for.

Riparian Reserve

Riparian Reserve includes lands along all streams, lakes, ponds, wetlands, unstable areas, and potentially unstable areas that are subject to special Standards and Guidelines designed to conserve aquatic and riparian-dependent species. The NWFP establishes a minimum protection buffer equal to the height of one site-potential tree, along each side of the riparian feature. For perennial fish-bearing streams this distance is two site-potential trees.

Administratively Withdrawn

Administratively Withdrawn areas are identified in current Forest and District Plans or draft plan preferred alternatives and include recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest and which are not included in calculations of allowable sale quantity (ASQ). The Horse Creek meadows and surrounding uplands and riparian reserves have been designated this land allocation. The information sign near the closure gate accessing the 2500121 road describes the management of this area.

"THIS AREA IS MANAGED SPECIFICALLY FOR WILDLIFE. THE ROAD IS CLOSED TO REDUCE VEHICLE DISTURBANCE AND WILL RESULT IN BETTER UTILIZATION OF THE AREA BY WILDLIFE.

A LARGE VARIETY OF HABITATS MAKES THIS AREA UNUSUAL. RIPARIAN AREAS, CEANOTHUS BRUSH-FIELDS, HARDWOODS AND CONIFER FORESTS, A POND AND MEADOW ATTRACT A LARGE VARIETY OF WILDLIFE.

WILDLIFE ENHANCEMENT PROJECTS WITHIN THE MEADOW AREA ARE A COOPERATIVE VENTURE BETWEEN THE U.S.D.A. FOREST SERVICE AND THE OREGON DEPARTMENT OF FISH AND WILDLIFE. PROJECTS INCLUDE SEEDING AND FERTILIZING, BURNING TO REMOVE DEAD GRASS AND STIMULATE NEW GROWTH, CUTTING OF INVADING TREES, AND INSTALLATION OF BIRD NESTING BOXES.

YOU ARE INVITED TO WALK THROUGH THE HORSE CREEK WILDLIFE AREA AND ENJOY THE WILDLIFE"

Management Direction for Roads

Current direction for road management is found in the Siskiyou National Forest's Land and Resource Management Plans (LRMP) (1989). The LRMP states, in part, to "Plan, design, operate and maintain a safe and economic transportation system to provide efficient access for the movement of people and materials involved in the use and protection of national forest lands." (Forest Management Goal 15; LRMP Page IV-2). Within the Forest Plan, specific Forest-Wide Standards and Guidelines for the Transportation System are summarized below:

Facilities: Transportation Planning

Guidance for transportation planning is found here on page IV-56 of the LRMP. Transportation planning analysis shall be conducted to compare feasible alternatives where choices that maximize net public benefits are not obvious from environmental and resource considerations. Direction for transportation planning is found in FSM 7710, Transportation Planning, and the Transportation Planning Handbook, FSH 7709 55.

The analysis for transportation alternatives should:

- Identify viable alternative routes from the planning area to available access points.
- Identify the long- and short-term needs for each road (service life).
- Determine the traffic criteria for each route.
- Evaluate existing and potential mineral material sources considering site development and rehabilitation as described under Minerals.
- Estimate development, maintenance, and user costs for economic comparison of alternatives.

- Recommend the road system and standards to meet the needs identified.
- Document the analysis, decisions, and management direction for preferred routes.

Construction and Reconstruction

Guidance for construction and reconstruction of roads is found on page IV-57 of the LRMP. The Road Development Plan includes the multiyear Capital Investment Program, the multiyear Timber Sale Program, and the Transportation Information System (TIS).

Design standards shall be based on resource management objectives, environmental constraints, user safety, environmental factors, traffic requirements, vehicle characteristics, road user, and economics.

New and reconstructed roads shall be planned, constructed, and managed to carry the anticipated traffic safely with a minimum impact to the land and other resources. In coordination with project interdisciplinary teams, specified construction methods shall include provisions for reducing environmental impacts, with emphasis to:

- Minimize impacts to soil and water values.
- Establish or protect native vegetation on cut and fill slopes and other disturbed sites off the roadway.
- Limit the spread of Port-Orford-cedar root disease where risk is present, and
- Limit the spread of noxious weeds where risk is present.
- Protect other resource values.

Temporary Roads

Guidance for use of temporary roads is found on page IV-57 of the LRMP. Construction of temporary roads should normally be discouraged. Roads planned and constructed as temporary roads should be obliterated as part of the project work. Methods used, timing, and mitigation and designed to re-establish vegetative cover on the disturbed area within a reasonable period of time, not to exceed 10 years after the termination of contract, lease or permit (36 CFR 219.27(a)(Il)). Those roads which subsequently are determined to be needed for additional use, or those not obliterated as planned, shall be entered into TIS with appropriate road management objectives developed.

Roads Analysis

All roads were reviewed by the IDT, resulting in 1.1 miles proposed to change their maintenance levels from ML2 (open, high clearance vehicles) to ML1 (long term storage, closed). Eleven and 1/10th miles of road are proposed to be changed from ML1 to Decommissioned. In addition, two roads which would remain ML1 roads, but were identified as needing stream crossing work to improve or restore hydrologic function while in storage, are also included. See Attachment C for the full report.

Logging Systems and Treatment Methods

This logging systems section covers a very brief overview of the proposed logging methods. This will introduce the basic methodology and machinery used to implement the restoration treatments.

Initial reconnaissance was conducted in the field determining the feasibility of stand treatments and the application of the transportation and logging system planning. Both existing and proposed transportation and logging systems were ground verified. Later, the interdisciplinary team documented all treatment units and the associated roads needs utilizing a GIS Analyst. Field work was accomplished per FSH 2409.18 – Timber Sale Preparation handbook; Chapter 30 – Project Analysis and Design, Gate 2:

> "Conduct field reconnaissance to develop sale designs. Since the most critical decisions involving funding and resource expenditures are required at Gate 2, conduct a more intensive field reconnaissance at Gate 2 than at Gate 1. Leave adequate flagging, stakes, marks, or other tracks in the field to ensure that sale preparation activities can continue in the most cost-effective manner practicable. FSM 2361 includes techniques for obtaining required archaeological resource clearances and FSM 2672.4 provides guidance on preparing biological evaluations.
>
> In salvage situations, use existing data and professional judgment to hasten the analysis process. The Land and Resource Management Planning Handbook, FSH 1909.12 and 36 CFR 219.27(d)(2)(iii) direct that unit size limitations must not apply to the size of areas harvested as a result of natural catastrophic conditions such as fire, insect and disease attack, or windstorm. Follow Regional guidelines for exceptions to unit size limitations in these situations.
>
> 31.2 - Documentation
>
> In timber sale project design documents include sufficient site-specific information, preliminary sale design, and appropriate management guidance to facilitate sale plan implementation at Gate 3. A timber sale project plan may include one or more timber sales or permit areas and must include the following:
>
> - Approximate cutting unit location and size.
> - Nature and condition of timber proposed for harvest.
> - Silvicultural prescriptions.
> - Selected logging systems information.
> - Locations and standards of local, collector, and specified roads.
> - Planned fuel treatments.
> - Location of key resource values.
> - Preliminary design for resource improvements.
> - Zones or areas with specific management requirements, constraints, or mitigation requirements.

- Financial and economic information as described in section 32."

Considerations for Application of Logging Systems

The proposal of system(s) to be used in any given stand is based on existing road access, new system or temporary road construction needs, as well as economic and technical feasibility identified for each treatment unit. The two primary concerns involved with use of the various logging systems is the potential detrimental effects to soils and the construction of new roads. New or temporary roads may be necessary due to the need for a change in the logging system design or to access areas that have no access, reflecting an adherence to current standards and guidelines set forth in the Forest Plan. Soil concerns elevate when ground based equipment is considered for use on steeper slopes, sensitive riparian areas, sensitive soil types, or unstable areas.

Conversely, there is an operational concern for economics between the various systems being considered, i.e., ground based systems are most economic from an operational cost viewpoint, skyline systems increase in operational costs, and aerial (full suspension or helicopter) systems are the most costly. Road access and landing accessibility with construction costs are also factors to consider.

The analysis area for logging systems and transportation access planning includes those roads that access or are proposed to be used in conjunction with implementation activities. Commercial units were proposed considering logical and economic access for these systems.

See Attachment A for an example of the detailed "paper planning" accomplished for the Project.

Logging System Options

Treatment units that provide opportunities for commercial extraction include ground-based systems, skyline cable systems, and aerial (helicopter) systems.

Ground Based Systems

This term refers to a group of logging methods that are considered ground-based, and may also include mechanized harvesting equipment. Typically, logs are harvested using mechanized heavy equipment to skid the logs to a landing area, where they would be loaded onto a truck. These machines either use a grapple or chokers to lift one end of the logs, providing one end suspension to reduce soil disturbance. These ground-based systems are usually utilized on terrain where slopes are less than 35 percent. In all cases, proposed skid trails should be pre-designated by the operator and approved by the Forest Service before felling and skidding. Skid trails should not be allowed to cross specified stream channels or only at Forest Service approved locations. In general, skid trail spacing should average 80 to 100 feet apart and located on the fall line, especially if using harvester-forwarder (cut-to-length [CTL]) systems due to the forwarder's high center of gravity. Skidders travel on designated skid trails that are designed to minimize soil disturbance in accordance with Forest Plan thresholds and for site specific resources. Assuming uniform conditions, a typical width of 12 feet; 80 foot spacing equals 15% of a unit, and 100 foot spacing equals 12%.

Landings for units with ground based systems can generally be located on gentle ground. If the project specifies that tops be left attached to the top log in ground based units, some log processing would be needed on the landings (i.e., the whole tree system, see below). This need would require slightly larger landings in order to accommodate the residual slash from the top log and residual limbs. Log processing can be accomplished by a relatively small and inexpensive "pull-thru" log processor or a more expensive and more efficient mechanical processor.

Mechanized harvesting is often utilized for felling of trees for ground based logging systems. This involves either a harvester or a feller-buncher, which fall the tree and bundle the logs for the skidder or tractor for easy pickup. These machines have a "felling-head" that is positioned on the end of a boom, which allows the machine to fell timber without walking to every tree. This mechanical felling can reduce residual stand damage by controlling the direction of the tree fall. It can also position logs to minimize where the skidder or tractor need to travel to facilitate log transport. Table 1 displays several examples of equipment configurations for the ground based systems.

Table 1. Examples of Equipment Configurations

GB System	Equipment configuration	Notes
Whole tree	Feller/buncher, grapple skidder, processor, loader, (mechanized felling)	Logs processed on landing. Manual felling may be required in some units for oversized trees, i.e., greater than 24".
Cut To Length	Harvester, forwarder, loader (mechanized felling)	Logs processed in woods. Manual felling may be required in some units for oversized trees, i.e. greater than 24".
Conventional	Manual felling, grapple or winch line skidder, loader	Process logs in woods or at landing (if at landing add processor in equipment).

Tractor - In this conventional system, a cutter will fall to lead toward designated skid trails, then limb and buck the tree in the bed where it landed when it was felled. Three methods of skidding can then be utilized, loader or shovel yarding, grapple skidding, or choker skidding. Shovel yarding consists of a heal boom loader grabbing the logs and swinging them towards the landing in stages. Grapple skidding uses swing grapples attached to the rear of the tractor. The clamps pick up one end of the log and the operator positions the log for skidding. When several logs are bunched, the grapple can pick up several ends at one time and skid the turn to the landing. The third method involves chokers that are attached to the logs and a tractor equipped with a winch pulls the logs from their beds into the skid trail. When a group of logs are assembled into a turn, the chokers are gathered together, the leading ends of the logs are suspended above the ground behind the tractor by way of an integrated arch or similar apparatus, and the trailing end of the logs drag along the ground on the way back to the landing. At the landing, a front-end or a knuckle-boom loader is used to sort and load logs decked at the landing onto log trucks.

"Winch/line" - Some areas of timber harvest where slopes generally exceed 35% slope but are relatively small – usually less than 250 feet wide – can be reached by a winch line from a ground based machine or reached from a road by a winch line or loader. The tractor uses a "bull line" to pull the logs to the skid trail or road. These inclusions are usually inside larger ground based areas and are considered part of the ground based system.

Rubber-tired Skidder - This system is essentially the same as tractor logging in technique, although the skidding equipment has some operational and functional differences. While most tractors have steel tracks with cleats that run along a rigid rail and tend to churn up some soil when it turns, rubber-tired skidders are often articulated in their middle instead of a rigid frame, and they displace somewhat less topsoil than a tractor would when it turns. Both types of equipment can have advantages, depending on the situation.

Typically, steel cleated tractors can work on somewhat steeper slopes, while rubber tired skidders are faster and average skidding distances can be somewhat longer. By virtue of the fact that both tractors and skidders bear the weight of one end of the logs being skidded, the weight of the machine skidding logs is not evenly distributed, but is instead concentrated near the back of the machine. This configuration can create disproportionately higher ground pressure on the soils being skidded upon than the machines rated or calculated pressure (in pounds per square inch) would indicate.

Harvester-Forwarder - A harvester and forwarder are two separate pieces of equipment. The harvester (while traveling on pre-designated harvester trails) reaches its boom out to cut the tree, and lays it on its side approximately perpendicular to the axis of the skid trail. Rollers on the cutting head then pull the tree through delimbing knives which drops the limbs in front of the harvester as they are severed. As each pre-determined length of log has been fed through the harvester head, logs are cut to length and allowed to fall into a stack of uniform length logs alongside the harvester trail. As the harvester travels through the stand, it rides on the layer of limbs that act as a cushion to help minimize soil compaction. Later, a forwarder uses the same trails to pick up the logs, load them onto its bunk, and transport the logs to the landing, completely free of the ground instead of dragging them behind the machine. Because the logs are transported free of the ground, the weight is evenly distributed over all of its wheels, so the resultant ground pressure is less than with other ground based systems. This method not only minimizes soil compaction, but it virtually eliminates any exposure of subsoil so there is rarely any detrimental displacement or erosion. Because of the specialized equipment, there is a slightly higher cost, compared to tractor or rubber-tired skidder.

Skyline

Skyline or cable logging is a system that transports logs from stumps to landings using a wire rope cable that is suspended between a tower and a tail tree. This cable (or skyline) functions as an overhead track for a load-carrying carriage. Logs are lifted by cables or other devices attached to the carriage and pulled into a skyline corridor. The carriage is then pulled to the landing by a mainline powered by a yarder. The skyline provides vertical lift so that the logs have their leading end suspended above the ground during inhaul. In some cases, the entire log may be suspended above the ground.

Skyline logging is generally specified where road access is available, on slopes greater than 35%, and/or where soil or water conditions are a concern. Typical skyline systems can effectively yard logs out to 1,000 to 1,200 feet. This capability inherently affects road locations where the yarder is positioned.

In all cases, one-end log suspension would be required in all skyline units. Where logs are to be yarded across specified stream channels or wet areas, full log suspension would be required over the designated stream channel. In order to get adequate deflection in some units, the skyline may have to be rigged across major streams and/or existing roads.

Guyline anchors are needed and should be adequate in most areas. However, in some locations multiple stump anchors, machine anchors, and/or “deadman” anchors may be needed. Guyline anchors should generally be green Douglas-fir 15” to 26” DBH and 40+ years of age. Guy trees would have to be felled before using the stumps as anchors. Tail tree and tail tree anchors would be needed on most skyline corridors. Tree sizes should be from 15” to 26”+ in most locations (Douglas-fir). Tail tree rigging heights may be up to 50 feet. Tree sizes and rigging heights should be guided by OR-OSHA Chapter 437, Division 6. The corridors are spaced as widely as feasibly and generally need to be no wider than 12 feet across.

Skyline landings would mostly be located in the road prism. Landing orientation would utilize both parallel and centralized (radial) configurations. In some cases, landings would need to be placed on narrow roads, therefore, a swing boom type yarder would be necessary. If the project specifies that tops be left attached to the top log in skyline units, some log processing will be needed on the landings (i.e., the whole tree system). This would require slightly larger landings and/or the back-haul of slash in order to accommodate the residual slash from the top log and residual limbs. Log processing could be accomplished by a relatively small and inexpensive “pull-thru” log processor or a more expensive and more efficient mechanical processor.

Hand felling of trees is generally used in this system, because steeper slopes are not conducive to mechanized felling operations. Cable yarding methods have the lowest impacts on soil resources, but are more expensive treatment method than ground based logging.

Skyline equipment would consist of a yarder/tower combination (see below), log loader, landing cat (D6 type), pull-thru or mechanical processor (if needed), mechanical slack pulling carriage, and radio. Labor would generally consist of the following: yarder engineer (1), loader operator (1), chaser (1), hooktender (1), rigging slinger (1), choker setter (1), and processor operator (1, if needed).

Ground based logging systems are more economical than cable logging systems. Ground based systems have more mechanization of operations, resulting in high production rates and lower labor costs. Cable logging operations have high costs of operations due to potentially lower production rates (logs to landing per day) and more labor is required for operations. Hand-felling of trees is a major cost consideration, as this work is dangerous, labor is expensive, and production is low in comparison to mechanized felling options. With current project design, this project is projected to have positive economic output and revenue for both ground based and skyline logging systems used for treatments.

Helicopter

Helicopters can be used to move material from the treatment area sites, and move them to processing areas (i.e., landings). From the landings, material can then be removed from the forest by trucks, utilizing roads suitable for such use. Helicopters are divided into three classes, depending on their lift capabilities. Helicopters have high operating costs and are usually utilized where there are concerns for ground disturbance or where road building is not desired. Aerial systems (e.g., helicopters) would be a system used to accomplish commercial density management where existing access systems are not available or would cause extensive resource damage if utilized. The use of helicopters allows for full suspension of trees or material from the treatment area to the landing area and does not create excessive ground disturbance via skid trails or skyline corridors.

This system can be utilized where there is no directly adjacent road access. There are limitations however on the flight distance and elevation change from the landing to the stand where material would be transported. Landings should be within a distance of approximately 1/2 mile from the treated stand. There are also other factors to consider regarding helicopter systems and economic feasibility, including turn size, maintenance and fuel storage landings, etc.

Potential log and service landing areas are available. Helicopter landings, in general, have an average size of about 80 feet by 200 feet and are located as close as possible to the harvest units they serve. However, the actual landing size and location can vary widely depending on terrain, slope, volume flown per acre, and flight direction. In general, landings should be cleared of trees and stumps and leveled as much as possible. In some cases, some surrounding green trees might have to be removed to facilitate flight direction. Some of the proposed landings associated with project area may be located on existing system roads, but others would need a temporary spur and a landing constructed. These locations would need approval from the Forest Service if proposed to be used. A typical helicopter side would need 2 landings, one primary and one secondary. For this system to be operating at maximum production, an alternate log landing would be needed. If the primary log landing is jammed up, the turn would drop its load at the secondary landing. Safety for the public, ground crew and the flight crew is essential. Since these helicopters are operating within the "dead man's curve" and autorotation options are limited, it is essential that the long line load lifting, flight path and drop zones are carefully considered. Service landing(s) need to be no more than 1 mile from the treatment units (less if possible) and accessible by highway fuel trucks.

The recommended equipment for this system would consist of a medium lift or heavy lift helicopter (sea level payload of 6,000 pound to 20,000 pounds). In addition, at least two loaders and various support vehicles would also be needed. Labor would consist of about 10 woods and landing crew personnel as well as pilots, support labor, and service labor.

Pre-Bunching

This system can be subordinate to any of the above systems. It typically involves machine cutting, weighing, and bundling logs to make log transport more efficient. A tracked, self-leveling machine can safely work on ground up to 50% slope gradient. Harvester trails for cable would be designed to not be greater than 15% of a treatment unit. A study of this type of logging was conducted on private land near Corvallis Oregon. When harvester trails are located perpendicular to the slope, and on slopes less than 60%, less than 3% of the trails had exposed soil. Compaction of the soil surface horizon is minimized with only one pass of the harvester. After one harvester pass on harvester/cable road, soil strength in vehicle tracks near the surface was 19 –34% higher than that in undisturbed soil (Zamora-Cristales et al 2014). Increased soil strength is a function of compaction. By making one pass through the stand and walking on slash and compacting and dispersing it, slash treatment costs can be bypassed and fire danger lessened. Within the last few years, development of cable-assist systems can substantially increase the ability to operate heavy machinery on steep slopes and avoid soil damaging slip which improves traction (Visser and Stampfer 2015). However the actual implementation and understanding of its limitations has not been fully tested. The study conducted near Corvallis, Oregon demonstrated that a production increase of 79% was realized. This equated to a cost savings of 58% (Flint and Kellogg 2013).

Use of this equipment can make all phases of the ground based, skyline, and helicopter logging considerably more economical and can also treat the slash at the same time. While pre-bunching could be used in any systems (where slopes allow), it is especially applicable to helicopter systems. The biggest cost factor in helicopter logging is the aircraft cost per hour; anything that can boost the volume per hour produced can bring down unit costs. Pre-bunching timber in a thinning unit into flyable bundles with a "cut-to-length" processing machine has been proven to maximize volume flown per hour. Production can be increased as the turns fly faster, loading is consistent, no excess weight (slash) is flown, landing impact and size are minimized, and labor and loading costs are cheaper. The estimated savings from this type of operation is estimated to be about 20% to 25%.

The use of the pre-bunching machines on difficult cable or helicopter treatment units would also facilitate removal of Douglas-fir that are intermingling with hardwoods. The boom and harvester head can directionally fell the tree out and away from the hardwoods that would normally be the cause of hang ups. With the ability to control the cut tree, the hardwoods would not need to be felled. When combined with whole tree yarding, slash would be removed and treated at the landing.

Timber harvest can be used as a tool to meet the project objectives. While economics may be one consideration for the decision maker, it is not an objective of this project to harvest timber and provide positive economic return to the government. Economics may be considered based on the cost to benefit ratio of the alternatives and how much restoration or enhancement work may be completed from revenues generated from timber harvest.

Timber Markets

Current timber markets have a relatively high value for Douglas-fir saw grade material. While the timber market fluctuates regularly based on global markets, local supply, and domestic demand, timber values have been relatively high following recovery after the 2008 recession. The State of Oregon summarizes pond values for all the regions of Oregon. Pond value is the price per unit (thousand board feet - Mbf) that a mill will pay for a particular grade of timber delivered to the mill. The average log prices by species and grade from 2015-2000 pond value for Douglas-fir is approximately $530 per Mbf (https://data.oregon.gov/Natural-Resources/Log-Prices/4v4m-wr5p/data). The Forest Service estimates MBF using east-side Scribner rules, therefore the volume as shown, is higher than if west-side, long log Scribner rules would be applied. This is due to the differences in scaling rules. This value is relatively high compared to previous years following the lows in the market following the 2008 recession.

Federal timber sales in 2015 and 2016 have been selling for high prices and attracting many bidders to each sale in these local markets. The bid rates have ranged from $230 per Mbf to $282 per Mbf. Variables that affected these bid rates include logging systems, haul distance to mills, quality of timber grades, and restrictions on operations. Upper Briggs treatment units have large areas of skyline with a lesser amount of ground based logging, and a portion of helicopter yarding. The proposed sale areas have quality timber grades, which will likely be appealing to local timber markets. These market conditions should result in good value for this project, resulting in revenue available for more restoration and enhancement.

Methods for Analysis

An economic efficiency analysis is used to compare alternatives based on expected revenues and expenses that are expected. This allows for calculation of a benefit to cost ratio. This analysis compares expected revenues from value created mostly from timber harvest to the costs that are expected to be incurred by the Forest Service to implement the project. No planning or NEPA costs are considered. This analysis only considers short term costs and revenues and doesn’t consider future, long term costs or revenues.

Project revenue is calculated by subtracting all costs required by the contract from the value of the timber delivered to the mill. The current pond value of $530/MBF east side scale and adjusted for product type and grade, and applied for southwest Oregon for the timber value delivered to the mill. The costs of getting the wood to the mill include logging and haul costs, road reconstruction and maintenance, and work required by the timber sale contract or stewardship contract. See Attachment B for tables of projected costs by stand. Averages from recent timber sale appraisals were used for the costs in the analysis. See Table 2 for costs used. Costs are listed by dollars per Mbf (thousand board feet). For the proposed action, the total costs of $13,599,429 are subtracted from the timber value of $15,588,648 resulting in total revenue of $1,989,219. The expected bid rate under the analysis scenario for the proposed action would be $250 per Mbf. Volumes per acre were projected from potential treatment scenarios developed in Forest Vegetation Simulator software. Predicted volume (Mbf) per acre removed for the proposed action is averaging 18 Mbf/acre.

Table 2. Costs for figuring project revenue.

Zone Averages Costs per Mbf	$/Mbf
Tractor Logging - Stump to Truck	$188
Skyline Logging - Stump to Truck	$246
Helicopter Logging – Stump to Truck	$700
Haul Costs	$86
Road Maintenance	$47
Road Reconstruction	$45
Brush Disposal	$7.84
Other Contract Costs	$12

To calculate economic efficiency, we subtract the total costs from the project revenue. This can be displayed as a ratio as well, which is the revenue to cost ratio (revenue/cost). Revenue to cost ratio value of 1 would mean that revenue would equal the costs to implement the project.

The financial cost not considered but incurred by the Forest Service include agency costs for contract administration, contract preparation, specialist time, engineering, and any mitigation measures that might be needed as a result of the project. The numbers used for this analysis are from previous projects and comparison of projects of similar complexity and size. The numbers should be used for relative comparison purposes only.

Alternative Comparison

There are large differences in economic effects between alternatives that have been developed in Upper Briggs Restoration EA. The no action alternative had only road maintenance costs. The proposed action has the highest economic efficiency for the Forest Service, while alternative 3 has a relatively low economic efficiency.

The proposed action has an economic efficiency ratio of 1.15. The proposed action alternative has total present net value of $1,989,219. This value is high due to more acres treated and timber volume removed in the proposed action when compared to other alternatives. The proportion of tractor and skyline logging, compared to helicopter yarding, also helps reduce logging operational costs. A comparison of economic efficiency when alternative 2 does not include the helicopter yarding shows the ratio goes up to 1.25. Helicopter yarding would require a higher cost of meeting restoration objectives. If the efficiency considerations are incorporated into the project implementation, every effort would be needed to help offset those higher costs. The timing of the year is a big factor as helicopters can lift more efficiently with cold dense air, usually occurring during the winter months, but road use and improvements also need to be realized. Utilizing machines to harvest timber and pre-bunch the loads would also help offset these higher costs.

The economic efficiency ratio tends to go up for the Forest Service with larger volumes and projects. Larger projects and volumes equal higher revenues and relatively lower costs for the Forest Service, resulting in better economic efficiency ratios. See Table 3 for the proposed action revenue calculations, and for economic efficiency comparison of alternatives.

Table 3. Present Net Value and Benefit/Cost Ratio Comparison Between Alternatives

Alternative	Volume in MBF	Total Estimated Benefit or Revenue from Sale of Timber	Total Estimated Cost	Present Net Value	Benefit-Cost Ratio (B/C)
1 No Action	0	0.00	$ 25,000	$ (25,000)	0.00
2 Proposed Action – Alt 2	29,413	$ 15,588,648	$ 13,599,429	$ 1,989,219	1.15
3 Alternative 3	17,090	$ 9,057,884	$ 8,732,032	$ 325,852	1.04
2 Alternative 2 w/o Heli	27,025	$ 14,323,080	$ 11,456,574	$ 2,866,506	1.25
3 Alternative 3 w/o Heli	13,987	$ 7,412,984	$ 5,946,893	$ 1,466,091	1.25

Note: - Values are meant to be used for the comparison of alternatives only and do not represent an expected selling value.

Alternative 3 has a lower economic efficiency ratio of 1.04. This effectively means the revenue generated by the project barely exceeds the costs incurred by the Forest Service to implement the project. The present net value for the project equals $325,852. This is largely due to the decreased acres being treated and $1,466,091 of helicopter costs included for the alternative. The economic efficiency is down substantially as well, due to the smaller project size and efficiency lost due to agency costs of implementation of smaller projects. Economic efficiency goes down as well because close to the same amount of road work would need to be completed as the proposed action, with substantially less revenue to pay for that road work.

This analysis clearly shows that there are some differences between the alternatives. The economic efficiency ratio of the proposed action is slightly higher than alternative 3. The $1,989,212 revenue that can potentially be generated by the proposed action in the form of retained receipts from a stewardship could potentially pay for a good amount of restoration projects. Revenue of $325,852 could be potentially generated from Alternative 3, but when considering the helicopter work to implement the contract, this equals very little net gain for the investment.   See attachment B for a breakdown of costs per treatment unit and by alternative.

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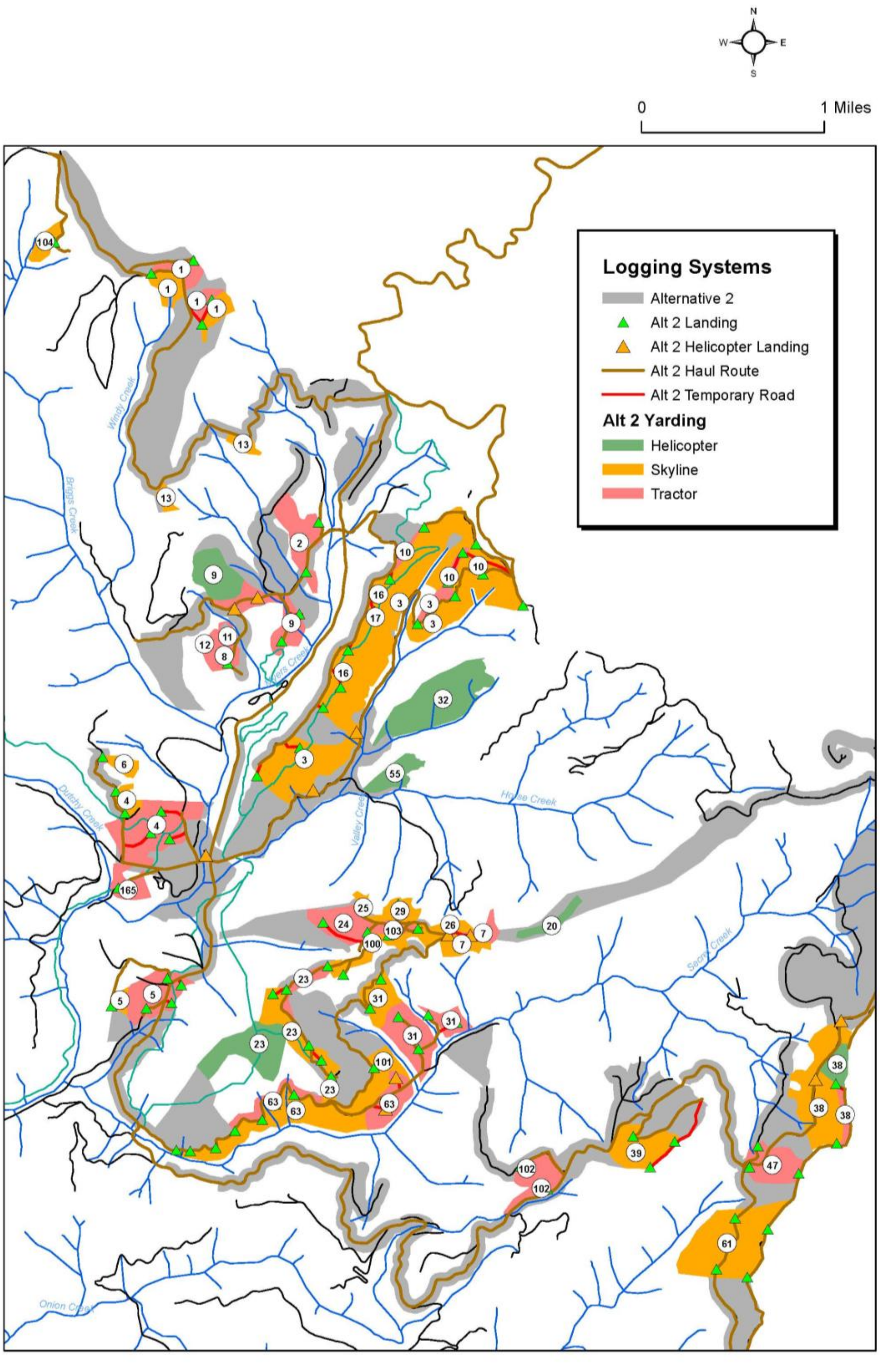
Attachment A - Example of Logging Systems Map

Upper Briggs Valley Restoration Project



Attachment B - Tables for Economic Efficiency Analysis

Alternative 2 Stand #	Acres	Proposed Logging System	Estimated Volume Removed (Mbf)	Estimated Volume Removed (CCF)	Total Costs of Operations	Pond Value Total	Total Revenue (Pond Value - Costs)
1	15.4	Tractor	111	204	$ 42,934	$ 59,015	$ 16,081
1	9.2	Tractor	67	122	$ 25,674	$ 35,290	$ 9,616
2	38.3	Tractor	618	1,133	$ 238,313	$ 327,573	$ 89,260
3	6.0	Tractor	119	218	$ 45,855	$ 63,029	$ 17,175
4	72.0	Tractor	932	1,709	$ 359,460	$ 494,096	$ 134,635
5	41.6	Tractor	540	989	$ 208,050	$ 285,975	$ 77,925
7	9.3	Tractor	325	596	$ 125,316	$ 172,253	$ 46,937
8	13.5	Tractor	178	327	$ 68,823	$ 94,600	$ 25,777
9	38.3	Tractor	1,685	3,089	$ 649,768	$ 893,138	$ 243,369
10	8.4	Tractor	185	340	$ 71,416	$ 98,165	$ 26,749
10	3.9	Tractor	33	61	$ 12,899	$ 17,730	$ 4,831
11	4.0	Tractor	69	127	$ 26,700	$ 36,701	$ 10,001
12	6.2	Tractor	304	558	$ 117,306	$ 161,243	$ 43,937
23	11.9	Tractor	166	304	$ 63,850	$ 87,765	$ 23,915
24	32.1	Tractor	794	1,456	$ 306,251	$ 420,957	$ 114,706
31	42.3	Tractor	1,137	2,085	$ 438,518	$ 602,764	$ 164,246
31	14.1	Tractor	378	693	$ 145,803	$ 200,413	$ 54,610
38	8.0	Tractor	67	123	$ 25,834	$ 35,509	$ 9,676
47	35.5	Tractor	247	453	$ 95,380	$ 131,104	$ 35,724
63	28.2	Tractor	228	418	$ 87,984	$ 120,938	$ 32,954
63	15.9	Tractor	225	412	$ 86,729	$ 119,214	$ 32,484
102	17.0	Tractor	119	217	$ 45,731	$ 62,860	$ 17,129
102	16.0	Tractor	113	207	$ 43,525	$ 59,828	$ 16,302
103	9.3	Tractor	145	265	$ 55,810	$ 76,713	$ 20,903
165	17.9	Tractor	232	425	$ 89,342	$ 122,804	$ 33,463
1	13.3	Skyline	96	177	$ 42,753	$ 51,133	$ 8,380
1	15.2	Skyline	165	303	$ 73,306	$ 87,675	$ 14,369
3	134.9	Skyline	3,516	6,446	$ 1,558,181	$ 1,863,615	$ 305,434
3	17.8	Skyline	351	643	$ 155,345	$ 185,795	$ 30,451
3	24.0	Skyline	791	1,450	$ 350,462	$ 419,159	$ 68,697
4	10.8	Skyline	267	490	$ 118,442	$ 141,659	$ 23,217
5	5.5	Skyline	71	130	$ 31,372	$ 37,521	$ 6,149
6	9.4	Skyline	233	427	$ 103,258	$ 123,498	$ 20,241
7	15.0	Skyline	522	956	$ 231,202	$ 276,522	$ 45,320
10	125.0	Skyline	2,764	5,067	$ 1,224,886	$ 1,464,988	$ 240,102
13	6.9	Skyline	124	228	$ 55,164	$ 65,977	$ 10,813
13	7.3	Skyline	66	120	$ 29,082	$ 34,782	$ 5,701
16	13.2	Skyline	239	438	$ 105,786	$ 126,523	$ 20,736
16	8.7	Skyline	168	307	$ 74,323	$ 88,892	$ 14,569
17	15.1	Skyline	292	536	$ 129,487	$ 154,869	$ 25,382
23	33.6	Skyline	710	1,302	$ 314,782	$ 376,485	$ 61,704
23	6.0	Skyline	147	270	$ 65,182	$ 77,960	$ 12,777
25	7.3	Skyline	159	292	$ 70,599	$ 84,438	$ 13,839
26	8.7	Skyline	136	249	$ 60,181	$ 71,978	$ 11,797
29	13.9	Skyline	235	431	$ 104,229	$ 124,660	$ 20,431
31	24.6	Skyline	599	1,098	$ 265,400	$ 317,424	$ 52,024
38	77.0	Skyline	1,328	2,434	$ 588,396	$ 703,734	$ 115,337
39	38.7	Skyline	1,013	1,857	$ 448,957	$ 536,961	$ 88,004
61	97.7	Skyline	2,419	4,435	$ 1,072,049	$ 1,282,192	$ 210,143
63	87.4	Skyline	797	1,461	$ 353,139	$ 422,361	$ 69,222
100	27.3	Skyline	427	782	$ 189,130	$ 226,203	$ 37,073
101	12.0	Skyline	252	462	$ 111,675	$ 133,566	$ 21,891

Alternative 2 Stand #	Acres	Proposed Logging System	Estimated Volume Removed (Mbf)	Estimated Volume Removed (CCF)	Total Costs of Operations	Pond Value Total	Total Revenue (Pond Value - Costs)
104	13.2	Skyline	119	217	$ 52,537	$ 62,835	$ 10,298
9	34.4	Helicopter	158	290	$ 141,907	$ 83,810	$ (58,097)
20	11.8	Helicopter	195	357	$ 174,826	$ 103,252	$ (71,574)
23	53.4	Helicopter	758	1,390	$ 680,436	$ 401,865	$ (278,571)
32	83.0	Helicopter	701	1,286	$ 629,413	$ 371,731	$ (257,682)
38	15.1	Helicopter	392	719	$ 352,219	$ 208,020	$ (144,199)
55	20.3	Helicopter	183	335	$ 164,054	$ 96,890	$ (67,164)
1	15.3	Tractor	111	204	$ 42,894	$ 58,960	$ 16,066
1	9.2	Tractor	67	122	$ 25,655	$ 35,264	$ 9,609
3	6.0	Tractor	98	179	$ 37,642	$ 51,741	$ 14,099
5	40.4	Tractor	795	1,457	$ 306,469	$ 421,257	$ 114,787
8	13.5	Tractor	175	321	$ 67,549	$ 92,849	$ 25,300
10	8.4	Tractor	108	199	$ 41,829	$ 57,496	$ 15,667
10	3.9	Tractor	135	247	$ 51,956	$ 71,415	$ 19,460
11	3.3	Tractor	43	79	$ 16,713	$ 22,973	$ 6,260
23	15.6	Tractor	684	1,253	$ 263,575	$ 362,296	$ 98,721
24	4.7	Tractor	103	189	$ 39,693	$ 54,559	$ 14,867
38	8.0	Tractor	69	126	$ 26,535	$ 36,474	$ 9,939
63	27.9	Tractor	478	876	$ 184,191	$ 253,179	$ 68,988
63	6.3	Tractor	311	571	$ 120,041	$ 165,002	$ 44,961
63	4.4	Tractor	61	112	$ 23,524	$ 32,334	$ 8,811
63	2.5	Tractor	63	115	$ 24,279	$ 33,373	$ 9,094
102	17.0	Tractor	457	838	$ 176,284	$ 242,311	$ 66,027
102	15.3	Tractor	410	751	$ 157,952	$ 217,112	$ 59,160
103	9.3	Tractor	78	143	$ 30,178	$ 41,481	$ 11,303
165	17.0	Tractor	118	217	$ 45,588	$ 62,663	$ 17,075
1	13.5	Skyline	109	200	$ 48,290	$ 57,755	$ 9,466
1	1.4	Skyline	20	38	$ 9,067	$ 10,844	$ 1,777
3	66.8	Skyline	465	852	$ 205,961	$ 246,334	$ 40,372
3	17.0	Skyline	120	220	$ 53,209	$ 63,639	$ 10,430
3	10.9	Skyline	170	311	$ 75,183	$ 89,921	$ 14,737
3	25.0	Skyline	323	593	$ 143,271	$ 171,355	$ 28,084
3	25.3	Skyline	184	337	$ 81,347	$ 97,292	$ 15,946
5	5.5	Skyline	59	109	$ 26,364	$ 31,532	$ 5,168
10	105.5	Skyline	2,751	5,043	$ 1,219,197	$ 1,458,184	$ 238,987
25	7.3	Skyline	143	262	$ 63,260	$ 75,660	$ 12,400
38	74.4	Skyline	2,450	4,491	$ 1,085,643	$ 1,298,450	$ 212,808
39	5.6	Skyline	139	255	$ 61,713	$ 73,810	$ 12,097
61	21.7	Skyline	281	515	$ 124,567	$ 148,984	$ 24,418
63	49.7	Skyline	1,226	2,248	$ 543,399	$ 649,916	$ 106,517
63	3.9	Skyline	134	246	$ 59,515	$ 71,182	$ 11,666
63	20.2	Skyline	448	820	$ 198,315	$ 237,189	$ 38,874
100	27.3	Skyline	494	906	$ 218,968	$ 261,890	$ 42,922
104	11.8	Skyline	106	195	$ 47,078	$ 56,306	$ 9,228
3	9.8	Helicopter	178	327	$ 160,152	$ 94,586	$ (65,567)
3	13.7	Helicopter	264	485	$ 237,235	$ 140,111	$ (97,124)
10	8.5	Helicopter	165	302	$ 147,993	$ 87,405	$ (60,589)
10	4.1	Helicopter	86	158	$ 77,172	$ 45,577	$ (31,594)
32	64.1	Helicopter	1,566	2,871	$ 1,405,253	$ 829,941	$ (575,312)
38	15.1	Helicopter	330	605	$ 296,249	$ 174,965	$ (121,285)
39	33.0	Helicopter	514	942	$ 461,086	$ 272,317	$ (188,769)
Totals			**17,090**	**31,329**	**$8,732,032**	**$ 9,057,884**	**$ 325,852**

Attachment C - Roads Analysis

Interdisciplinary Team project-level roads analysis process for

Upper Briggs Restoration Project

During an Upper Briggs project meeting on 8/11/2016, the IDT reviewed roads recommended for decommissioning in the 1997 Briggs Creek Watershed Analysis (USDA Forest Service, 1997), the Rogue River-Siskiyou National Forest Forest-wide Travel Analysis Report (i.e. Subpart A) map of roads likely not needed for future use (USDA Forest Service, 2015), and resource specialist knowledge of roads in the Upper Briggs planning area. At this meeting a list of roads was developed for further field review to develop a project-level recommendation for each road (refer to 8/11/2016 IDT meeting notes). Field reviews occurred during the fall and winter of 2016 by the project hydrologist, soil scientist, and zone roads engineer. Findings were presented and discussed with the full IDT at an Upper Briggs project meeting on 1/18/2017, with the Wild Rivers District Ranger making a final recommendation on future management for each road.

All roads that are being proposed to change their maintenance levels (ML), such as from ML2 (open, high clearance vehicles) to ML1 (long term storage, closed), or from ML1 to Decommissioned, including the suite of activities that would be implemented to effect that change, were then incorporated into the Upper Briggs Restoration Project for IDT analysis of effects. In addition, two roads which would remain ML1 roads, but were identified as needing stream crossing work to improve or restore hydrologic function while in storage, are also included. This list of roads is displayed in Table 1. Table 2 displays total miles proposed for decommissioning, conversion to storage (ML1), and number of locations of stream crossing improvement.

Table 1. Roads Proposed for a change to Maintenance Level (ML), and/or with proposed stream crossing improvement, in the Upper Briggs Restoration Project EA.

Road Number	Current ML	Summary of Actions	ML Recommendation	Miles of ML change
2402149	ML1	Relocate Trail 1146 Dutchy Creek-Chrome Ridge TH to FSR 2402; restore roadbed, convert to trail 1146	Decommission	0.3
2402150	ML1	Relocate Trail 1146 Dutchy Creek-Chrome Ridge TH to RSR 2402; restore roadbed, convert to trail 1146	Decommission	0.7
2402610	ML1	Relocate unofficial 1146 TH to FSR 2402; restore roadbed	Decommission	0.9
2500099	ML1	Improve hydrologic function of Myers Creek tributary stream crossing; restore roadbed from 2500606 junction to end	ML1/Decommission	0.3
2500100	ML2	Restore roadbed from Windy Creek to end; pull 5 foot culvert & restore Windy Creek channel	Decommission starting at Windy Creek culvert, to end	0.7
2500121	ML1	Improve hydrologic function at 3 tributary stream crossings to Smith Creek	ML1	n/a

2500152	ML1	Restore roadbed	Decommission	0.7
2500160	ML2	Restore roadbed	Decommission	0.8
2500162	ML2	Restore roadbed	Decommission	0.2
2500163	ML2	Restore roadbed; pull landing fill out of stream channel	Decommission	0.1
2500172	ML2	Place road into Storage	ML1	0.4
2500175	ML1	Restore roadbed	Decommission	0.7
2500603	ML2	Restore roadbed; pull 3 stream crossing culverts and restore channels	Decommission	1.0
2500605	ML1	Restore roadbed	Decommission	0.5
2500608	ML1	Restore roadbed	Decommission	0.1
2500609	ML1	Restore roadbed; pull 1 stream crossing culvert and restore channel	Decommission	0.4
2500617	ML1	Restore roadbed; pull Smith Creek, Horse Creek, and 6 tributary culverts, restore channels	Decommission	1.5
2500660	ML1	Restore roadbed	Decommission	0.2
2500665	ML2	Restore roadbed	Decommission	1.2
2500667	ML2	Restore roadbed	Decommission	0.1
2500668	ML2	Restore roadbed	Decommission	0.1
2500670	ML2	Restore roadbed	Decommission	0.2
2500671	ML1	Restore roadbed	Decommission	0.2
2509032	ML2	Place road into Storage	ML1	0.8
2509631	ML2	Place road into Storage	ML1	0.1
2509632	ML2	Place road into Storage	ML1	0.1
2509633	ML2	Place road into Storage	ML1	0.2
2512632	ML2	Restore roadbed; convert to trail 1146	Decommission	0.2

FSR = Forest System Road
TH = Trail Head

“Restore Roadbed” would include any combination of the following potential actions for road decommissioning: shallow ripping, deep subsoiling, partial to full roadfill pullback/recontouring, mulching/placing slash, pulling cross-drain and drainage culverts and associated fill, shaping stream crossings to natural channel dimensions, water-barring, seeding, planting, and blocking the entrance with a barrier (such as berm construction and/or boulder placement). No ground disturbing actions may be needed where a roadbed is already on a successful passive restoration trajectory.

“Storage” would include any combination of the following potential actions for converting a road to ML1: pulling cross drain and drainage culverts and associated fill, ripping or subsoiling a portion of the roadbed, installing rolling dips, waterbarring, seeding, mulching/placing slash, and blocking the road entrance with a barrier (such as berm or gate).

“Improve hydrologic function” would involve standard road maintenance storm-proofing treatments that reduce road impacts to water quality and improve road drainage and stream crossing function, such as adding aggregate, upgrading stream crossings to withstand a 100-year storm event, adding rolling dips, improving the ditch line and adding ditch relief culverts.

Table 2. Proposed changes to the road system in the Upper Briggs Restoration Project, for all action alternatives.

Miles converted to Storage (ML1)	Miles Decommissioned	Number of stream crossings storm-proofed on ML1 roads
1.6	11.1	4

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